



HUMAN EXPLORATION

NASA's Journey to Mars

EARTH RELIANT

MISSION: 6 TO 12 MONTHS
RETURN TO EARTH: HOURS



Mastering fundamentals
aboard the International
Space Station

U.S. companies
provide access to
low-Earth orbit

www.nasa.gov

PROVING GROUND

MISSION: 1 TO 12 MONTHS
RETURN TO EARTH: DAYS



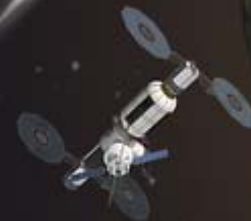
Expanding capabilities by
visiting an asteroid redirected
to a lunar distant retrograde orbit

The next step: traveling beyond low-Earth
orbit with the Space Launch System
rocket and Orion spacecraft



MARS READY

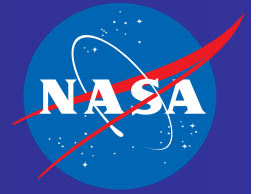
MISSION: 2 TO 3 YEARS
RETURN TO EARTH: MONTHS



Developing planetary independence
by exploring Mars, its moons and
other deep space destinations



The Human Research Program



A Risk Reduction Strategy for Human Space Exploration

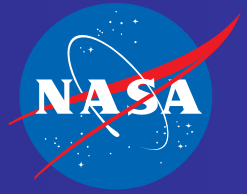


The Human Research Program (HRP) investigates and mitigates the highest risks to human health and performance, providing essential countermeasures and technologies for human space exploration. Risks include physiological effects from radiation, hypogravity, and terrestrial environments, as well as unique challenges in medical support, human factors, and behavioral health support.

<http://humanresearchroadmap.nasa.gov/>

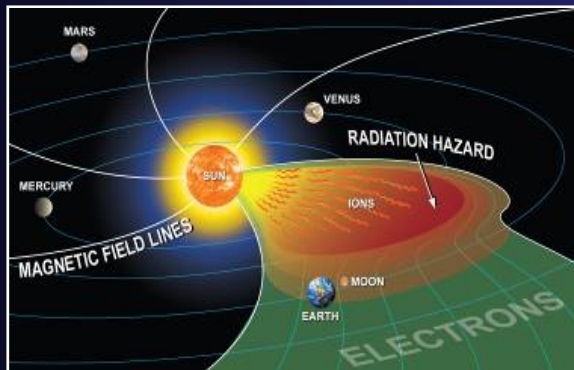


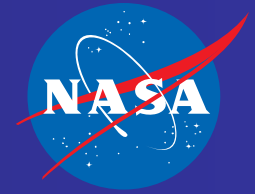
NASA Space Radiation Program Research Priorities



Space Radiation Program Element

- *Risk of Radiation Carcinogenesis from Space Radiation Exposure*
- *Risk of Acute or Late Central Nervous System Effects from Space Radiation – inflight cognitive or behavioral changes that impact mission success and late neurological disorders*
- *Risk of Cardiovascular Disease and other Degenerative Tissue Risks from Space Radiation*
- *Acute Radiation Risks from Solar Particle Event Exposure – prodromal risks, immune system dysfunction and skin injury that jeopardize crew health and mission success*





Research Opportunities

Space Radiation Program Element

Human Exploration Research Opportunities (HERO)

Solicitation: NNJ13ZSA002N

<http://nspires.nasaprs.com/external/>

- **Appendix A:** NASA Research and Technology Development to Support Crew Health and Performance in Space Exploration Missions
- **Appendix B:** The National Space Biomedical Research Institute (NSBRI) Research and Technology Development to Support Crew Health and Performance in Space Exploration Missions
- **Appendix C:** NASA Human Research Program Omnibus Opportunity
- **Appendix D:** Differential Effects on Homozygous Twin Astronauts Associated with Differences in Exposure to Spaceflight Factors
- **Appendix E:** Ground-Based Studies in Space Radiobiology
- **Appendix F:** International Life Sciences Research Announcement (ILSRA)
- **Appendix G:** NASA Specialized Centers of Research (NSCORs) for Ground-Based Studies in Cancer Risks and Cognitive and Behavioral Central Nervous System Risks from Space Radiation
- **Appendix H:** Behavioral Health and Performance

2015 NASA Space Radiation Summer School:

<http://spaceradiation.usra.edu/nsrss/>

Information on Space Radiation Health Risks:

three.usra.edu

